

LBNE LAr Parameters Spreadsheet

Version 10.5 - 10/18/2011

Changes highlighted in RED
unhide columns to see 34 kton option

33 kton

Input value
Calculated
Reference Design, 800'

Quality Meaning

- *** Stable, well understood parameter
- ** Reasonably well defined parameter
- * Rough estimate

Parameter	Value	Units	Quality	Notes
Anode Plane Assembly (APA)				
Cathode Plane Assembly (CPA)				
Detector Module				
Cryostat module				
Electronics				
High Voltage				
Cryogenics				
Num recirculation pumps per cryostat	4		**	Provides redundancy during operation. None during initial purification
Recirculation pump flowrate (purity maintenance)	47,000	kg/hr	**	Maximum turn over rate chosen to be ~twice of ICARUS
	34	m^3/hr		
	148	gpm		
Recirculation pump flowrate - max	188,000	kg/hr		
	135	m^3/hr		
	592	gpm		
LAr volume turnover @ max flowrate	5.5	days		
Pump power - hydraulic	6.5	kW		Assumes 30m (60 psi) head pressure
Pump rated power - electric	12.6	kW	**	
Pump refrigeration load - max	50.5	kW		Assumes 30m (60 psi) head pressure, all pumps on
Insulation thickness	1	m	**	
Insulation thermal conductivity	0.0283	W/m-K	**	fiber reinforced polyurethane at Tavg = (Tconc+Targon)/2
Concrete temperature	278	K		Heated 5 K above freezing
Insulation heat loss	5.41	W/m^2		$Q''=(k/L)*(dT)$
Insulation heat loss	27.2	kW		
Piping and purification vessel heat load	2.0	kW	*	
LAr storage dewar heat load	2.0	kW	**	D-Zero LN2 & LAr dewars are 1.1 kW each
LN2 storage dewar heat load	2.0	kW	**	D-Zero LN2 & LAr dewars are 1.1 kW each
Purifier regeneration cool down load	30.0	kW	*	24 hour cool down
Refrigeration load - nominal, purity maintenance	66.0	kW		assumes filter regenerations every 2 days
Refrigeration load - max during initial purification	103.9	kW		
Num refrigeration plants	3		***	One operating per cryostat and one standby/supplemental
Refrigeration unit capacity - nominal	60	kW	**	From Arup concept report
Refrigeration turn up, turn down range	20	%	***	from manufacturer
Refrigeration unit capacity - maximum	72	kW		
Refrigeration plant capacity - max	216	kW		Both plants in operation
Refrigeration plant margin	8%			
Refrigeration plant power input	569	kW	**	Scaled from Arup 2010 concept report, 59 kW machine
Refrigeration plant heat output	142	kW	**	Scaled from Arup 2010 concept report, 59 kW machine
LAr Heat of vaporization	161.4	J/g	***	At ullage pressure, 0.98 bar absolute, REFPROP see cryo sheet.
LAr boil-off rate - nominal	1473	kg/hr		
LN2 storage dewar capacity	50	m^3	**	One dewar backs up entire refrigeration plant
LN2 Heat of vaporization	183	J/g	***	At 3 atm
LN2 density	0.7559	g/cm^3	***	At 3 atm
LN2 consumption rate - nominal	1.7	m^3/hr		Normal operation w electronics on
LN2 consumption rate - minimized non-operating	0.9	m^3/hr		
LN2 storage dewar backup time- both cryostats full	29	hrs		Based on minimal, non-operating load
Detector Depth				
Radioactive Background				
Veto System				
Veto Configuration				
Veto Counter				
Photon Detector				
DAQ				
Cavern & Pit				